

said wing design, said installation coordination features in said flanges accurately locating said spars within said engineering tolerances relative to said wing panels by registration of said coordination features in said spar flanges with corresponding coordination features in said wing panels;

said wing panel coordination features machined therein using a cutting bit in a machine tool under control of a controller programmed with a program incorporating data from said digital wing product definition, said digital wing product definition specifying locations of said wing panel coordination features in said wing panel for positioning said wing spars at said certain positions relative to said wing panels when said wing panel coordination features are in registry with corresponding coordination features in said spar flanges.

78. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 77, wherein:

said coordination features in said spar flanges include at least one coordination hole drilled adjacent one end of said spar, and said coordination features in said wing panels include corresponding coordination holes drilled in said wing panels by a drill bit in said machine tool.

79. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 78, wherein:

said coordination features in said spar flanges include an edge surface on said flanges extending alongside and in spaced relationship to edge surfaces of said wing panels, which constitute corresponding coordination features on said wing panels.

80. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 78, further comprising:

in-spar ribs fastened at opposite ends thereof between said wing spars to rib posts attached to said spars;

said in-spar ribs having upper and lower flanges, said upper and lower flanges attached intermediate opposite ends thereof to said wing panels.

81. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 80, wherein:

said in-spar ribs are attached to said wing panels at preestablished positions by fasteners extending through fastener holes drilled through said upper and lower flanges of said in-spar ribs and through said wing panel, said fastener holes coinciding with coordination holes predrilled through said upper and lower flanges of said in-spar ribs and said wing panels and aligned with one another to position said ribs relative to said wing panel at said preestablished positions;

said preestablished positions existing in a digital model of said wing residing in said digital wing product definition, said fastener holes drilled by a machine tool under control of said controller programmed with a program incorporating said digital wing product definition data that specifies locations of wing-panel-to-rib-flange fastener holes for securing said in-spar ribs to said wing panels at positions specified in said digital wing product definition and achieved in said wingbox when said coordination holes in said in-spar ribs are aligned with corresponding coordination holes in said wing panel.

82. (Currently Amended) A determinantly assembled airplane wingbox ~~as defined in claim 81, wherein, comprising:~~

at least two wing spars extending generally parallel to each other and separated chord-wise between upper and lower wing panels, each of said wing spars having an elongated upright web with upper and lower flanges, said flanges each having installation coordination features machined therein;

said wing spar flanges fastened to said upper and lower wing panels at said certain positions thereon and within engineering tolerances specified by a digital wing product definition established by an ultimate engineering authority for said wing design, said installation coordination features in said flanges accurately locating said spars within said engineering tolerances relative to said wing panels by registration of said coordination features in said spar flanges with corresponding coordination features in said wing panels;

said wing panel coordination features machined therein using a cutting bit in a machine tool under control of a controller programmed with a program incorporating data from said digital wing product definition, said digital wing product definition specifying locations of said wing panel coordination features in said wing panel for positioning said wing spars at said certain positions relative to said wing panels when said wing panel coordination features are in registry with corresponding coordination features in said spar flanges;

said coordination features in said spar flanges include at least one coordination hole drilled adjacent one end of said spar, and said coordination features in said wing panels include corresponding coordination holes drilled in said wing panels by a drill bit in said machine tool;

in-spar ribs fastened at opposite ends thereof between said wing spars to rib posts attached to said spars;

said in-spar ribs having upper and lower flanges, said upper and lower flanges attached intermediate opposite ends thereof to said wing panels;

said in-spar ribs are attached to said wing panels at preestablished positions by fasteners extending through fastener holes drilled through said upper and lower flanges of said in-spar ribs and through said wing panel, said fastener holes coinciding with coordination holes predrilled through said upper and lower flanges of said in-spar ribs and said wing panels and aligned with one another to position said ribs relative to said wing panel at said preestablished positions;

said preestablished positions existing in a digital model of said wing residing in said digital wing product definition, said fastener holes drilled by a machine tool under control of said controller programmed with a program incorporating said digital wing product definition data that specifies locations of wing-panel-to-rib-flange fastener holes for securing said in-spar ribs to said wing panels at positions specified in said digital wing product definition and achieved in said wingbox when said coordination holes in said in-spar ribs are aligned with corresponding coordination holes in said wing panel;

said wing panels include wing skins and attached stringers, said stringers extending span-wise of said wingbox and lying between said ribs and said wing skins;

said stringers and said ribs have thickened pad-ups at locations at which said ribs intersect said stringers, said coordination holes extending through said pad-ups;

whereby said coordination holes provide enhanced certainty that said rib and said stringer pad-ups will vertically align within tolerance, enabling a reduction in area and weight of said pad-ups compared to conventional wings.

83. (Currently Amended) A determinantly assembled airplane wingbox as defined in claim 80, wherein:

said rib posts are positioned on said spars at certain positions and ~~temporarily~~-fastened thereon by ~~temporary~~-fasteners extending through aligned coordination holes in said rib posts and corresponding coordination holes in said spar webs, said certain positions existing in a digital model of said wing residing in said digital wing product definition.

84. (Currently Amended) A determinantly assembled airplane wingbox as defined in claim 83, wherein:

said rib posts are attached to said spar webs at said certain positions by ~~permanent~~-fasteners extending through fastener holes in said rib posts and said web;

said fastener holes in said rib posts and said web are drilled by said machine tool and said ~~permanent~~-fasteners are inserted and secured while said rib posts are ~~temporarily~~-secured in said certain position by said ~~temporary~~ fasteners extending through said aligned coordination holes.

85. (Canceled)

86. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 83, wherein:

said coordination holes in said rib posts and said spar webs drilled by at least one machine tool under control of at least one controller programmed with a program incorporating said digital wing product definition data that specifies locations of said coordination holes in said rib posts and said spar webs for aligning and positioning said rib posts on said spar webs at said certain positions specified in said digital wing product definition and achieved in said wingbox when said coordination holes in said rib posts are aligned with said corresponding coordination holes in said spar web.

87. (Previously presented) A determinantly assembled airplane wingbox as defined in claim 77, further comprising:

a plurality of aileron hinge ribs attached to a rearmost one of said wing spars and projecting rearwardly therefrom;

said hinge ribs each having a distal end in which is mounted a hinge barrel, said hinge barrels being axially aligned with hinge barrels on other of said

hinge ribs on an axis at a position and within engineering tolerances specified in said digital product definition;

said hinge ribs each having an attachment fitting fastened to said rearmost spar, said attachment fitting positioned on said rear spar by mounting said hinge barrel on a positioning pin accurately located in space to the rear of said rear spar at a position specified by said digital wing product definition as the desired position for said hinge bushing in a distal end of said aileron hinge rib, and fastening said attachment fitting to said spar web at a position on said web which results in minimal movement of said hinge barrel when said locating pin is removed.

88. (New) A determinantly assembled airplane wingbox, comprising:

at least two wing spars extending generally parallel to each other and separated chord-wise between upper and lower wing panels, each of said wing spars having an elongated upright web with upper and lower flanges, said flanges each having installation coordination features machined therein;

said wing spar flanges fastened to said upper and lower wing panels at said certain positions thereon and within engineering tolerances specified by a digital wing product definition established by an ultimate engineering authority for said wing design, said installation coordination features in said flanges accurately locating said spars within said engineering tolerances relative to said wing panels by registration of said coordination features in said spar flanges with corresponding coordination features in said wing panels;

in-spar ribs fastened at opposite ends thereof between said wing spars to rib posts on said spars;

said in-spar ribs having upper and lower flanges, said upper and lower flanges attached intermediate opposite ends thereof to said wing panels;

said wing panels include wing skins and stringers, said stringers extending span-wise of said wingbox and lying between said ribs and said wing skins;

said stringers and said ribs have thickened pad-ups at locations at which said ribs intersect said stringers, said coordination holes extending through said pad-ups;

whereby said coordination holes provide enhanced certainty that said rib and said stringer pad-ups will vertically align within tolerance, enabling a reduction in area and weight of said pad-ups compared to conventional wings;

said wing panel coordination features machined therein using a cutting bit in a machine tool under control of a controller programmed with a program incorporating data from said digital wing product definition, said digital wing product definition specifying locations of said wing panel coordination features in said wing panel for positioning said wing spars at said certain positions relative to said wing panels when said wing panel coordination features are in registry with corresponding coordination features in said spar flanges.